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Globalization and interdependence: Science, technology and innovation for development

Science, technology and innovation for development

Report of the Secretary-General

Summary

The present report, prepared by the United Nations Conference on Trade and Development in response to General Assembly resolution 70/213, provides information on the implementation of the resolution, in particular through the work of the Commission on Science and Technology for Development, the United Nations Conference on Trade and Development and other relevant United Nations organizations. The report summarizes trends in new and emerging technologies and their impact on sustainable development; showcases lessons learned and good practices from developing countries in strengthening capacities for science, technology and innovation; highlights findings from high-level policy discussions and research on science, technology and innovation as an enabler of sustainable development at the national, regional and global levels; discusses the review of progress made in implementing the outcomes of the World Summit on the Information Society; and highlights initiatives to strengthen the science-policy interface within the United Nations and enhance global support mechanisms for science, technology and innovation.

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I. Introduction

1. The present report responds to General Assembly resolution 70/213, in which the Assembly requested the Secretary-General to submit to it, at its seventy-second session, a report on the implementation of the resolution.

2. In its resolution 70/213, adopted 22 December 2015, the General Assembly recognized the vital role that science, technology, and innovation can play in sustainable development, including efforts to eradicate poverty, achieve food security and nutrition, protect the environment, improve education, and support and accelerate economic diversification and transformation.

3. The General Assembly expressed concern that, for the majority of the poor, the promise of science, technology and innovation remains unfulfilled and that many developing countries lack affordable access to information and communications technology (ICT).

4. The General Assembly encouraged the United Nations Conference on Trade and Development (UNCTAD), along with other United Nations entities, to continue to undertake reviews of policy on science, technology and innovation in order to assist developing countries in identifying measures needed to integrate such policies into their national development strategies.

5. The General Assembly also requested the Commission on Science and Technology for Development to continue its activities relating to science, technology and innovation and provide a forum within which to continue to assist the Economic and Social Council as the focal point in the system-wide follow-up to the outcomes of the World Summit on the Information Society.

6. The General Assembly reaffirmed its commitment to leveraging science, technology and innovation, including ICT, for the achievement of the internationally agreed development goals, including the 2030 Agenda for Sustainable Development.

7. Governments were encouraged to strengthen and foster investment in research and development, promote the involvement of the business and financial sectors in the development of environmentally sound technologies and mainstream a gender perspective in legislation, policies and programmes to facilitate full and equal access to and participation in science, technology and innovation for women of all ages. Scientific and research and development institutions were encouraged to promote regional, subregional and interregional joint research and development projects, where feasible.

8. The international community was encouraged to support efforts to conduct empirical research on innovation and development, enhance capacity-building support to developing countries, facilitate technology transfer on mutually agreed terms and other actions, and support science, technology and innovation partnerships with developing countries in education, business opportunities and infrastructure for science, technology and innovation.

9. In response to the resolution, the present report will summarize trends in new and emerging technologies and their impact on sustainable development; showcase lessons learned and good practices from developing countries in strengthening capacities for science, technology and innovation; highlight findings from high-level policy discussions and research on science, technology and innovation as an enabler of sustainable development at the national, regional and global levels; discuss the review of progress made in implementing outcomes of the World Summit on the Information Society; and highlight initiatives to strengthen the

science-policy interface within the United Nations and enhance global support mechanisms for science, technology and innovation.

II. Science, technology and innovation for achieving sustainable development

10. Science, technology and innovation are critical drivers for the achievement of the Sustainable Development Goals and offer the potential for a world of far greater — and more equally shared — economic prosperity, social inclusion, and environmental sustainability.

11. New and emerging technologies, which are often considered to be part of a fourth industrial revolution, include: the Internet of things, big data, cloud computing, artificial intelligence/robotics/automation, three-dimensional printing, biotechnology, nanotechnology and advanced materials, virtual and augmented reality, and smart energy. The pace of development and adoption of many of those digitally enabled technologies has been accelerated by "Moore's Law",[1] which led to a vast increase in capability at an exponential, non-linear rate and to exponential-price performance improvements throughout much of the digitized realm. The increasing use of digital platforms as a basis for technological convergence may accelerate the pace of technological change and the declining costs in digital products and services (e.g., gene editing, 3D printing, workplace automation). Exponential cost declines are also affecting the energy sector, with dramatic cost decreases in solar power, which has already become cost-competitive with coal and natural gas, as well as electric vehicles and batteries.[2]

12. Although new and emerging technologies offer unprecedented opportunities for addressing pressing global challenges, they can also disrupt labour markets, exacerbate existing socioeconomic inequalities and accelerate environmental degradation. Furthermore, without the requisite infrastructure, human resources and institutional and related capabilities for benefiting from such technologies, many developing countries may not be able to harness the positive potential of such technologies for sustainable development.

13. The Commission on Science and Technology for Development, as the United Nations focal point for science, technology and innovation for development, plays a significant role in analysing how science, technology and innovation, including ICT, serve as enablers in the 2030 Agenda by acting as a forum for strategic planning, sharing lessons learned and best practices and providing foresight about critical trends in science, technology and innovation in key sectors of the economy, as well as drawing attention to emerging and disruptive technologies.

14. In this regard, the Commission devoted its nineteenth and twentieth sessions, in 2016 and 2017, to critically examining how new and emerging technologies,

[1] "Moore's Law," named after Intel co-founder Gordon Moore, is the observation that approximately every 18-24 months the number of transistors in a dense integrated circuit doubles.

[2] Furthermore, recent findings show a strong tendency, across different types of technologies (including chemical, hardware, energy and others) towards exponential growth rates in production and exponential decreases in cost. However, it has been argued that governmental and regulatory policies, as well as the unique cost and performance characteristics of specific technologies, may result in certain families of technologies not exhibiting the exponential cost declines reflected in digital technologies. See, for example, Béla Nagy and others, "Statistical Basis for Predicting Technological Progress", *PLoS ONE*, vol. 8, No. 2 (February 2013); and Philip Ball, "Moore's law is not just for computers: mathematical laws can predict industrial growth and productivity in many sectors", *Nature* (March 2013).

along with existing scientific and technical applications, could support the efforts to achieve the Sustainable Development Goals. In order to promote synergy with the Goals, as reviewed by the high-level political forum on sustainable development on an annual basis, the Commission analysed the role of science, technology and innovation in the achievement of Goal 2 on food security and Goal 11 on sustainable cities. Moreover, the Commission sought to understand how key considerations for applying technology in development, including technology foresight and assessment, innovative financing, the application of a gender lens to science, technology and innovation, and regional and international cooperation, can ensure that no one is left behind.

A. New and emerging digital technologies

15. Two key features of new and emerging technologies have been digitization and connectivity. With the entire global population rapidly becoming connected through mobile Internet, new opportunities are expanding for exploiting the vast array of new and emerging digitally enabled exponential technologies to address the efforts towards the Sustainable Development Goals. Drawing on an analysis of four technology megatrends, namely big data and the Internet of things, three-dimensional printing, and digital automation, the Commission identified the potential of such technologies to accelerate the achievement of the Goals.

16. Across various domains, big data and the Internet of things have roles to play in advancing the sustainable development agenda, including through the provision of mobile-enabled microinsurance for farmers, mapping data that supports the allocation of medicine and mobilization of health teams to respond to disease outbreaks, devices powered by the Internet of things for smarter water management and monitoring progress towards achieving the Sustainable Development Goals.

17. The Commission concluded that some countries, especially the least developed countries, may not have the data infrastructure, capacity or skills to support such applications. Furthermore, the Commission discussed how Internet access, privacy, security and consumer rights may be critical issues to be understood and addressed in order to minimize possible risks associated with such technologies.

18. Additive manufacturing, or three-dimensional printing, involves creating physical products by iteratively layering desired material into a three-dimensional structure. Applications for such printing are vast, including in enterprise development, environmental sustainability, housing and construction and education. However, the technology presents a number of challenges, including potential disruption of employment and trade patterns, environmental effects in terms of energy consumption and their reliance on plastics as inputs, and implications for intellectual property, data privacy and protection.

19. Digital automation and artificial intelligence refer to the ability of computers to increasingly take over tasks related to cognitive and not just physical work. The automation of work has historically and in contemporary times had significant implications for government policy on employment, labour markets and overall economic policies. On the positive side, it means that machines can do the routine, predictable work, freeing people to be more creative and productive. However, it could also lead to a rise in unemployment in certain economic sectors, both in developed and developing countries.

20. The Commission developed a number a policy lessons to effectively harness new and emerging digital technologies for sustainable development. First, the basic requirements for taking advantage of ICT are still pertinent. Both old and new technologies have the potential to create economic and social opportunities or

exacerbate socioeconomic divides and it is important to continue to address the fundamentals of development policy. In addition, responding to the local context and harnessing local skills are fundamental to maximizing the benefits of ICT. Furthermore, such digital technologies as big data, the Internet of things and automation present significant challenges in relation to the protection, sharing and stewardship of data, and policymakers should strike the appropriate balance between promoting innovation and safeguarding citizens' rights.

B. Science, technology and innovation for achieving Goals 2 and 11

21. The Sustainable Development Goals have been adopted at a critical juncture in the international development discourse, where social inclusion and environmental sustainability are prioritized alongside economic development. With the vision of "no one must be left behind", the 2030 Agenda has raised the bar and demands unprecedented actions and efforts. It is clear that in the new global development agenda, islands of prosperity surrounded by poverty, injustice, climate change and environmental degradation are viewed as neither sustainable nor acceptable.

22. For the global community, such ambitious goals will be practically impossible to achieve by 2030 without a paradigm shift that incorporates the effective, widespread and inclusive application of technology and innovative ideas. In this context, the Commission analysed how new innovation approaches can support the achievement of the Goals more broadly and how science, technology and innovation can address two specific Goals, namely, Goal 2 on food security and Goal 11 on sustainable cities.

1. Goal 2: zero hunger by 2030

23. New innovation approaches, along with new applications of science, technology and innovation, can potentially play a critical role in achieving global food security. About 795 million people are undernourished, a ratio of 1 in every 9 persons, with the majority living in developing countries and rural areas. Efforts towards the achievement of Goal 2, zero hunger, are challenged by a number of factors, including climate change, access to food and water, soil degradation and desertification, changes in dietary patterns, expanding populations and low or slowing productivity growth. Smallholder farmers are disproportionately affected because of their limited access to food and financial resources.

24. The Commission discussed how science, technology and innovation can address the multidimensional nature of food security, which covers: (a) food availability, (b) access to food, (c) food utilization and use, and (d) food stability. Examples include: genetic modification and irrigation technologies for improving agricultural productivity; post-harvest and agroprocessing technologies that address food accessibility; biofortification that helps to make food more nutritious; and climate-smart solutions, including the use of precision agriculture and early warning systems, for mitigating food instability. Furthermore, new and emerging technologies, including synthetic biology, artificial intelligence and tissue engineering, could have implications for the future of crop and livestock agriculture.

25. The Commission agreed that in order to take advantage of the transformative potential of technology, an innovative ecosystem, supporting mechanisms and infrastructure are critical for enabling the agricultural innovation needed to eradicate hunger by 2030. Key areas for policy consideration include nurturing agricultural innovation ecosystems, making innovative investments in agriculture and promoting regional and international cooperation.

26. Harnessing science and technology for food security requires an agricultural ecosystem of innovation, encompassing farmers, agricultural research and education systems, agricultural extension systems, agricultural innovation policies and investments, agricultural value chain actors and organizations, as well as the links among them. Designing and strengthening an agricultural innovation system involves promoting research and development, investing in infrastructure, building human capacity, creating an enabling environment and strengthening knowledge flows, among scientists and farmers in particular. In that context, the Commission encouraged Member States to create coherent policy frameworks that encourage interministerial coordination for food security, to provide an enabling framework for agricultural innovation and to establish appropriate regulatory frameworks.

27. As a key component of strengthening the agricultural ecosystem for innovation, the Commission recommended that Member States increase investment in high-quality research that is adapted to the needs of smallholder farmers. The Commission encouraged countries to consider linking their national agricultural research institutions with the Food and Agriculture Organization of the United Nations (FAO) and the Consortium of International Agricultural Research Centers, in order to create new education and research programmes that support agricultural innovation.

28. Another key policy area is that of promoting regional and international cooperation for agricultural innovation and food security. Knowledge aid can be a tool for providing support in science, technology and innovation as part of official development assistance. This can occur in the agricultural sectors, where donors can contribute to agricultural research and development, especially in the least developed countries. With respect to stimulating industry and infrastructure, knowledge aid as part of official development assistance can focus on value-chain development schemes (e.g., agroprocessing), complementing foreign direct investment and the development of linkages, project funding for industrial and physical infrastructure, the promotion of global engineering associations and non-governmental organizations and the facilitation of South-South collaboration in agricultural innovation.

2. Goal 11: smart cities and infrastructure

29. The Commission also explored how science, technology and innovation can play a critical role in the design, development and management of smart cities to make human settlements in urban areas safe, comfortable, resilient and sustainable. More than half of the global population resides in cities. Current urbanization trends suggest that by 2030, 60 per cent of the world's population will live in cities. By 2050, this estimate will increase to two thirds. The 2030 Agenda for Sustainable Development recognizes the importance of that trend in Goal 11, on making cities and human settlements inclusive, safe, resilient and sustainable.

30. Smart, sustainable cities are innovative cities that use ICT to increase the efficiency of urban services and operations and improve quality of life in ways that ensure economic, social and environmental sustainability. Examples of smart applications include smart buildings that improve the comfort of the users and optimize the usage of utilities, as well as smart energy systems that utilize smart grids and energy management techniques at the household and community levels to optimize energy usage and distribution. Other examples include smart water supply, smart waste management, smart mobility and smart health.

31. The Commission identified five challenges related to smart cities and infrastructure, especially in the context of developing countries, and discussed the role of the science, technology and innovation community in overcoming those

challenges. First, smart infrastructure should be locally relevant and respond to local development needs. Second, the design, management and maintenance of smart infrastructure require new knowledge and skills and the Commission highlighted the need for a better understanding of the types of knowledge and skills required, as well as of the skills deficit, especially in developing countries.

32. A third issue is finance and the need for well-developed business models to implement smart infrastructure. Smart infrastructure projects require the pooling of public and private resources through creative financing and carefully designed public-private partnership models. A fourth challenge related to smart cities is governance. The Commission debated how to break down the silos across different government departments and balance top-down approaches to governance with bottom-up models that ensure the active involvement of citizens. The fifth issue the Commission deliberated was how to make smart cities inclusive. The Commission presented several examples of the innovative use of open platforms and applications to engage citizens in city planning and management, support communities from informal settlements, make urban planning gender-sensitive and engage the disabled and elderly communities.

33. The Commission concluded its discussion of those challenges with a review of general design principles that may guide smart infrastructure projects. First, smart infrastructure should be people-centred, rather than technology-centred. Second, smart infrastructure should be resilient to threats posed by such factors as climate change, extreme weather events and increased urban density. Third, smart infrastructure projects should be flexible, so as to allow for future upgrading and continuous improvement and ensure interoperability with other smart infrastructure components. Finally, smart infrastructure, owing to its inherent connected structure and digital components, opens up new risks related to data security and vulnerability to cyberattacks. Cities should invest in appropriate risk mitigation and safety strategies.

C. New innovation approaches to leave no one behind

34. Ensuring that no one is left behind requires an inclusive approach to the application of science, technology and innovation in development. In this context, the Commission analysed five approaches to innovation: pro-poor and inclusive innovation; grass-roots innovation; mission-oriented innovation (e.g., grand challenges and prizes); innovation with social purposes; and digitally enabled open and collaborative innovation. These new innovation approaches seek to solve problems generally not addressed by markets or the public sector, and they largely extend the number of actors participating in the innovation processes.

35. Greater use of the Internet, digital technologies and social networks have allowed for faster learning, enabled the co-creation of knowledge and provided widespread access to tools, data and resources to solve problems at a faster pace than would have been possible through the use of traditional ways to organize innovation. Such developments have significantly contributed to the experimentation with new ways to conduct innovation. Approaches that broaden innovation processes can involve the poor, as co-creators of technologies, as well as grass-roots and local communities in the development of new forms of knowledge and technological artefacts.

36. The Commission developed a number of recommendations to catalyse the use of those new innovation approaches to drive the achievement of the Sustainable Development Goals. The Commission proposed that Member States consider adopting policy mixes across various government actors that enable hybrid forms of

traditional, pro-poor, grass-roots and social innovation, while prioritizing innovation that is both socially inclusive and environmentally sustainable. The Commission encouraged countries to recognize and support the knowledge of local communities and local populations in innovation processes and to support efforts to commercialize and scale up locally developed innovations. The Commission supported the mainstreaming of corporate social responsibility policies in the private sector that reflect inclusive and sustainable innovation to meet the Goals. Finally, the international community was encouraged to provide networking opportunities and facilitate matchmaking between local innovative solutions and private-sector actors or policymakers who can work on scaling up and deploying new innovations.

D. Key considerations in applying science, technology and innovation in sustainable development

37. In order to ensure the appropriate and inclusive application of science, technology and innovation for sustainable development, the trade-off between the benefits and risks of applying science, technology and innovation for achieving the Sustainable Development Goals must be evaluated carefully, through technology foresight and assessment. A "gender lens", reflecting the aims, concerns, situations and abilities of both women and men, should be applied in all aspects of related policymaking. Regional and international cooperation should be promoted to build national capacities for science, technology and innovation and to support the networking and collaboration of researchers and innovators on issues of regional and global concern. Finally, financial and other resources should be made available to support the application of innovation for sustainable development.

1. Technology foresight and assessment

38. Throughout the 2016 and 2017 sessions, the Commission analysed the role of technology foresight and assessment in providing countries with the knowledge needed to evaluate the developmental potential of existing, new and emerging technologies. Technology foresight is the process of forecasting the evolution of technologies and their impact on society, with a view to developing policy within Governments or strategy within firms. Technology foresight is related to technology assessment, which was extensively developed in the 1960s and coincided with the rise of the environmental movement during the same period. The notion that policymakers needed informed, objective information on the potential benefits and risks of new technologies became more prominent in international institutions and national governments. Managing risks and public perceptions of science, technology and innovation are essential to harnessing them for the achievement of the Sustainable Development Goals by 2030.

39. The Commission encouraged countries to explore ways and means of conducting national, regional and international technology assessment and foresight exercises on existing, new and emerging technologies and their implications for sustainable development. It was suggested that Member States link foresight and assessment exercises to the implementation of the Goals and to discussions about models of governance for new areas of scientific and technological development. The international community was encouraged to conduct foresight and assessment initiatives on global and regional challenges at regular intervals and cooperate towards the establishment of a mapping system to review and share technology foresight and assessment outcomes. It was also recommended that the international community raise awareness and facilitate networking and partnerships among various technology foresight and assessment organizations and networks, in

collaboration with other stakeholders. Finally, the Commission encouraged structured debate among all stakeholders, including representatives of government, science, industry, civil society and the private sector, in particular, small and medium-sized enterprises, towards: (a) considering the perspectives of the multiple stakeholders involved; (b) creating a shared understanding of risks, potential benefits and long-term issues; and (c) building consensus on future policies.

40. The Commission was encouraged to continue to provide a forum for the sharing of, among other things, best practices, the results of foresight exercises, successful local innovation models, case studies and experiences regarding the use of science, technology and innovation and ICT for sustainable development. Furthermore, UNCTAD was encouraged to look into the feasibility of including elements of strategic foresight and digital ecosystem assessment in policy reviews of science, technology and innovation and ICT, possibly by including a chapter dedicated to these themes in such reviews.

2. Applying a gender lens to science, technology and innovation

41. As the only functional commission of the Economic and Social Council with a Gender Advisory Board, the Commission continues to analyse the gender implications of applying innovation and knowledge in the service of sustainable development. While Goal 5 is specifically directed at gender equality (achieve gender equality and empower all women and girls), the Commission recognized that there are gender dimensions across the Goals and a need to target strategies regarding science, technology and innovation in keeping with this reality.

42. There are at least four dimensions to a gender analysis of initiatives to apply science, technology and innovation for sustainable development. First, there is a need to identify where the applications thereof can improve the lives of women and men, girls and boys. Second, it is critical to identify and consider the gender dimensions of research and development, how agendas and priorities are set and how costs and benefits are distributed across populations, including to women and men, girls and boys. Third, it is important to explore the opportunities and to expand the roles of women in order for them to contribute to the human capital needed to advance science, technology and innovation for development, thereby adding to the number of women active in those fields and adding their perspectives thereon to those of men. Fourth, there is an urgent need to develop metrics and assessment tools that can produce data that are sufficiently disaggregated to determine the impacts of science, technology and innovation for development on women and men, girls and boys, and appropriately matrixed to track progress and interactions across Goals.

43. In order to address the ongoing and persistent gender gap in the fields of science, technology and innovation as a whole, and of science, technology, engineering and mathematics education in particular, the Commission encouraged efforts to mentor, attract and retain women and girls in education and research in the fields of science, technology, engineering and mathematics. The Commission's Gender Advisory Board has been involved in an international initiative, known as "GenderInSITE" that promotes the role of women in science, innovation, technology and engineering and demonstrates that applying a gender lens to those areas can help to improve the effectiveness of development programmes.

3. Financing innovation for development

44. Achieving the Goals requires addressing a range of resource constraints, including those relating to financial, technological and skills aspects, as well as in other areas. Financing research and innovation on the basis of specific missions

(e.g., renewable energy, development of vaccines or diagnostic tests for developing countries, agricultural innovations, etc.) can incentivize collaboration among different stakeholders. It is important for policymakers to understand the underlying monetary and non-monetary motivations that drive innovators and to design incentives that consider such motivations. Key policy considerations in this area are the choice of economic instruments used (for example, prizes or advance market commitments) and their design; the combination of vertical and horizontal mechanisms for funding; opportunities for combining financing from all sources (including government and private sector sources and national and international sources); and the process used for identifying priorities.

45. The Commission recommended support for policies that increase financial inclusion, deepen the sources of financing and direct investments towards innovations that address the Goals. In that context, it was recommended that countries provide incentives to private and public investors for impact investment, the commercialization of research and development, increased venture capital funding and the establishment of technology parks and incubators. The Commission was encouraged to discuss and explore innovative financing models, such as impact investment, as a means of attracting new stakeholders, innovators and sources of investment capital for science, technology, engineering and innovation-based solutions, in collaboration with other organizations, where appropriate.

4. Regional and international cooperation

46. The Commission acknowledged the importance of supporting the policies and activities of developing countries in the fields of science and technology through North-South, South-South and triangular cooperation in the areas of financial and technical assistance, capacity-building and technology transfer on mutually agreed terms and conditions, as well as technical training programmes or courses.

47. The Commission encouraged the facilitation of university-to-university collaborations involving student and faculty exchanges, two-way mobility and cooperative research aimed primarily at increasing capacities for science, technology and innovation and the cross-border flow of talent in the areas of science, technology, engineering and mathematics for sustainable development. In order to contribute to alleviating the constraints faced by developing countries, especially the least developed countries and small island developing States, the Commission proposed the creation of a resource access hub in support of the Sustainable Development Goals, a vehicle that would be the repository of projects, data, financing mechanisms, technological advances and directories of experts as well as for sharing success stories, difficulties and obstacles encountered by countries.

48. The Commission also recommended the establishment of international needs-based partnerships, where countries and their private sectors can collaborate on research and development, including the commercialization of research results, to address similar development challenges.

III. Building capacity for science, technology and innovation

49. Applying science, technology and innovation to the sustainable development agenda requires scientific and technological capacities. To that end, United Nations system entities work with developing countries to integrate science, technology and innovation into national development strategies; support capacity-building to develop statistics and indicators for measuring innovation and the knowledge economy; build competencies to help policymakers design and implement policies

relating to science, technology and innovation; strengthen ICT capacities to facilitate digital inclusion, implement ICT applications and promote e-commerce in developing countries; and facilitate technology transfer and build the capacities of countries to harness intellectual property for sustainable development.

A. Integrating policies on science, technology and innovation within national development strategies

50. The United Nations Conference on Trade and Development completed science, technology and innovation policy reviews of the Islamic Republic of Iran, in 2016, and of Rwanda, in 2017, and presented the results of both reviews at the twentieth session of the Commission. Such reviews support national governments in their efforts to integrate policies for science, technology and innovation into their national development strategies.

51. One noteworthy finding of the reviews was the need for policies to leverage science, technology and innovation as part of the diversification of productive structures. In that regard, the reviews found that dedicated efforts to support knowledge-based firms could deliver positive results in emerging industries, such as nanotechnology in the Islamic Republic of Iran or ICT in Rwanda. However, replicating the experience in more traditional industries and sectors was a significant challenge. Successful high-technology innovation loci, such as ICT industry innovation hubs and centres of excellence, could be helpful in stepping up the development of technological receptiveness throughout the entire economy. It was a common finding of the reviews that, outside of high-technology sectors, the business culture tended to be more conservative and incentives for investment and technological upgrading might be insufficient.

52. Another common finding of the reviews was that policy relating to science, technology and innovation needs to strengthen innovative interactions among stakeholders in order to make development more inclusive and improve sustainability. Such a move would involve technology demand-side measures targeting firms and entrepreneurs and supported through national academic research and international cooperation, thereby facilitating a greater involvement of women and youth, and carefully designed public-private partnerships for supporting innovative and technology-led ventures.

53. It was also stressed in the reviews that the development of strong national innovation capabilities is important for creating a comparative advantage that supports sustainable development. In that respect, countries needed effective funding mechanisms for science, technology and innovation, as well as to more effectively leverage international trade and investment linkages.

54. The experience of UNCTAD in the implementation of such reviews points to the need for a more broadly shared approach to innovation policy for development among public sector officials and other stakeholders. The response to that need forms the rationale for a new innovation policy learning programme launched by UNCTAD to provide training on key areas in collaboration with local training and policy institutions.

B. Developing statistics, indicators and data for innovation

1. Partnership on Measuring Information and Communication Technology for Development

55. The Partnership on Measuring Information and Communication Technology for Development has been working since 2004 to increase the availability of internationally comparable data on ICT and to build the capacity of national statistical offices to produce such data for evidence-based policymaking. The Partnership is composed of 14 United Nations and other entities, and reports every two years to the Statistical Commission.

56. The Partnership is contributing to the monitoring of six indicators to the monitoring framework for the Sustainable Development Goals (see E/CN.3/2017/2, annex II) and launched a task group on ICT for the Sustainable Development Goals in June 2017 that will propose a thematic list of ICT indicators, along with methodological guidelines, as a subset of the thematic list on indicators on science, technology and innovation being developed by the United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute for Statistics (also a member of the Partnership).

57. In addition, the partners continue their capacity-building work with national statistical offices and producers of official statistics on ICT in developing countries, in the form of courses, workshops and manuals. The Partnership also identifies areas where data disaggregated by sex exist or would be desirable, and the methodological work needed in order to develop relevant indicators to fill the data gaps. The partners also conduct research and analysis based on ICT statistics in their respective areas of competence.

2. Development of indicators on science, technology and innovation

58. The United Nations Educational, Scientific and Cultural Organization, through the UNESCO Institute for Statistics, is actively engaged in the development of indicators on science, technology and innovation for the Sustainable Development Goals, including contributions to the revision of the Organization for Economic Cooperation and Development (OECD) Frascati Manual on measuring research and development (target 9.5 of the Sustainable Development Goals) as well as the OECD/Eurostat Oslo Manual on measuring innovation. The Institute has also contributed to the collection of ocean science data, which have been included in the Global Ocean Science Report and which inform target 14.a of the Goals.

59. The Institute, in partnership with the Division of Science Policy and Capacity-Building of UNESCO, is developing better measures of gender equality in science, technology, engineering and mathematics, through its science, technology, engineering and mathematics and gender advancement project. The project contributes to targets 4.3, 5.5, 5.c, 9.5 and 17.18 of the Goals. While the Addis Ababa Action Agenda of the Third International Conference on Financing for Development has a section devoted to the critical role of science, technology, innovation and capacity-building in achieving the Goals, in the global indicator framework there are very few indicators on science, technology and innovation.[3] Therefore, the Institute is currently developing a thematic list of relevant indicators for the Goals.

60. The Institute is supporting countries in the collection of indicators on science, technology and innovation through regional workshops and technical assistance at

[3] For more information, please see: https://unstats.un.org/sdgs/.

the national level. A capacity-building package has been developed, which can be implemented by countries that are starting or expanding their measurement efforts.

3. Big data indicators for sustainable development

61. The Global Pulse initiative works to implement and promote opportunities to use big data and artificial intelligence for development and humanitarian action through a two-pronged strategy, in which it functions both as an innovation driver and as a catalyst for the formation of a new data ecosystem.

62. In its role as innovation driver, Global Pulse provides joint innovation as a service to national institutions and United Nations system entities for developing, piloting and evaluating applications of new data to inform development and humanitarian outcomes. In its role as a data ecosystem catalyst, Global Pulse works to foster an enabling environment for using new sources of data by developing regulatory frameworks and standards, connecting research communities, enabling capacity-building and driving policy work. In order to gain access to and use the vast amounts of data that the private sector owns, Global Pulse engages a growing number of companies in data philanthropy, whereby companies grant access to data, technology tools and resources to the public sector for projects for the public good.

63. Global Pulse is involved in a number of projects that aim to support the official statistics community in indicator measurement in the context of the Sustainable Development Goals. Moreover, Global Pulse is a member of four task teams of the Statistical Commission Global Working Group on Big Data for Official Statistics.

4. Global Innovation Index

64. The Global Innovation Index is co-published by Cornell University, INSEAD and the World Intellectual Property Organization (WIPO). In addition to providing a ranking of innovation performance in 130 countries, the index seeks to identify policies that foster environments conductive to innovation.

65. Every year, the Global Innovation Index model is updated and revised on the basis of the latest knowledge on innovation systems theory and a thorough review of available indicators, as well as on the basis of readership feedback from the international community and users of the index (policymakers, academia, practitioners, etc.).

66. Developing countries increasingly design policies intended to improve their innovation capacity. Aside from the yearly rankings, the Global Innovation Index identifies best practices of countries that consistently overperform when compared with those of a similar level of development, providing inspiration from innovation leaders and champions. The index results also offer the possibility of making intraregional and intra-income group comparisons, which provide a more realistic basis for action.

5. Indicators on telecommunications and information and communications technology

67. The International Telecommunication Union (ITU) collects telecommunication/ICT data for about 200 economies worldwide, covering over 100 indicators. The indicators can be divided into three key sets of data: telecommunication/ICT infrastructure and access data; data on entry-level prices to ICT services; and data on access to and use of ICT by households and individuals.

68. The definitions of indicators are discussed and agreed in the Expert Group on Telecommunication/ICT Indicators and in the Expert Group on ICT Household Indicators. ITU has in recent years produced two key documents supporting

countries in the collection of such data: the Handbook for the Collection of Administrative Data on Telecommunications/ICT and the Manual for Measuring ICT Access and Use by Households and Individuals.

69. The International Telecommunication Union is actively supporting the monitoring of efforts to achieve the Goals and is responsible for five indicators in the monitoring framework. In addition, ITU assists governments in developing countries in their ICT data collection and dissemination efforts through capacity-building technical workshops.

C. Strengthening capacity in information and communications technology

1. eTrade for All

70. Launched in July 2016 by UNCTAD, eTrade for All is a global initiative that helps developing countries engage in and benefit from e-commerce. It is organized around seven key policy areas of particular relevance to e-commerce development, ranging from e-commerce assessments to ICT infrastructure and services, payments and logistics, legal and regulatory frameworks, skills development and financing for e-commerce.

71. At the heart of the initiative is the eTrade for All platform (etradeforall.org), a new information hub launched in April 2017 that helps countries navigate the supply of technical and financial services available to drive development through e-commerce. Through the platform, countries can connect with potential partners, learn about trends and best practices, access up-to-date e-commerce data and be informed of upcoming e-commerce events. As part of the initiative, readiness assessments provide a rapid analysis of the current e-commerce situation in the seven key areas and identify opportunities and obstacles that can be addressed with appropriate policy measures. The new initiative has received significant interest from the least developed countries and from potential donor countries.

72. As of May 2017, eTrade for All encompasses 23 partners from international and regional organizations, national entities and development banks. With the aim of fostering inclusive development, the initiative also works in close cooperation with a private sector-led advisory council, Business for eTrade Development, that encompasses more than 30 large corporations and small businesses from both developed and developing countries.

2. Promoting digital inclusion

73. The International Telecommunication Union has a work programme that includes a focus on the digital inclusion of women and girls, youth, children, persons with disabilities and indigenous peoples. ITU focuses on ICT accessibility policies and practices for persons with disabilities in line with article 9 of the Convention on the Rights of Persons with Disabilities. A model ICT accessibility policy report was developed to guide ICT policymakers in developing their own national ICT accessibility policies focusing on mobile, web, television and public access centre accessibility, along with the public procurement of accessible ICT.

74. The International Telecommunication Union is also leading the digital skills thematic area of the Global Initiative for Decent Jobs for Youth, a global initiative of more than 20 United Nations system entities led by ILO. ITU also leads the International Girls in ICT Day campaign to encourage more girls and young women to prepare for and take up ICT careers. To date, the programme has reached more than 300,000 girls and young women in over 160 countries. Finally, training is

provided to indigenous leaders on using ICT for their own social and economic empowerment.

3. Information and communications technology applications and services for sustainable development

75. Information and communications technology applications and services are an important demand-side driver that can encourage the adoption of broadband services. The capacity of States members of ITU to develop national e-strategies to foster an enabling environment for scaling up ICT applications was built in the area of e-health through a high-level joint ITU-World Health Organization digital health policy dialogue, technical assistance on national e-health strategies, and the development of a toolkit and implementation guidelines for a digital health platform. In the area of e-agriculture, a joint ITU-FAO e-agriculture strategy guide was published and regional workshops and an e-agriculture solutions forum were organized by ITU and FAO. In the area of e-learning, UNESCO and ITU held a policy forum on mobile learning and published a policy note on mobile learning.

76. The capacity of countries to leverage ICT and/or mobile applications to improve the delivery of value-added services was improved through the public-private deployment of innovative ICT applications that provide effective solutions to a variety of challenges for sustainable development, including a global joint initiative known as "Be he@lthy, be mobile", with mobile health programmes on smoking cessation, diabetes, cervical cancer and chronic obstructive pulmonary disease launched in multiple countries. Awareness was raised among ITU members and advocacy conducted on ICT for the development of best practices on smart cities and smart ICT for sustainable development.

D. Facilitating technology transfer for sustainable development

77. The World Intellectual Property Organization, in cooperation with national and regional industrial property offices, supports the establishment and development of technology and innovation support centres, which are designed to provide innovators in developing countries with access to locally based, high quality technology information services and other related services.[4] To date, there are 60 States members of WIPO implementing national projects to develop networks of technology and innovation support centres and over 600 individual such centres within those networks.

78. In order to support the development of technology and innovation support centres and raise awareness of intellectual property and technology information among local stakeholders, national planning and training events are organized on site, focusing on accessing and effectively using patent and scientific and technical journal databases, as well as on promoting the sharing of best practices and experiences. In order to further strengthen online training and encourage the exchange of experiences, a knowledge management platform, known as "eTISC", provides social media tools and integrates new services aimed at reinforcing WIPO activities in supporting the development of such centres worldwide, including specially targeted e-learning modules, tutorials and webinars.

79. Two public-private partnership programmes facilitate access to subscription-based databases. The Access to Research for Development and Innovation programme provides access to scientific and technical information in developing

[4] For more information, see www.wipo.int/tisc.

countries.[5] It offers access to over 28,000 peer-reviewed scientific and technical journals and e-books, with over 900 user institutions currently registered. The Access to Specialized Patent Information programme is a similar public-private partnership with the world's major commercial patent database vendors, providing access to more advanced and sophisticated search and analysis tools for use by institutions in developing countries and in the least developed countries.[6]

IV. Implementation of the outcomes of the World Summit on the Information Society

80. In accordance with the mandate of the Economic and Social Council and the General Assembly, most recently in their resolutions 2017/21 and 70/125, respectively, the Commission on Science and Technology for Development serves as the focal point in the system-wide follow-up to the outcomes of the World Summit on the Information Society. In 2016 and 2017, the Commission's work on the topic covered three main areas: (a) reporting on the follow-up to the World Summit outcomes; (b) promoting dialogue and building consensus on furthering the implementation of the World Summit; and (c) supporting the work of the Working Group on Enhanced Cooperation, established as a follow-up to the overall review of the implementation of World Summit outcomes carried out in 2015.

A. Follow-up to the World Summit outcomes

81. In 2015, the General Assembly carried out an overall review of the implementation of World Summit outcomes. The review concluded with a high-level meeting, held on 15 and 16 December 2016 in New York. In the outcome document of that meeting, the General Assembly assessed progress to date, identified gaps and challenges and made recommendations for the future on ICT for development, bridging digital divides, the enabling environment, financial mechanisms, human rights, building confidence and security in ICT, and Internet governance (see A/70/125).

82. The General Assembly requested the holding of a high-level meeting on the overall review of the implementation of World Summit outcomes in 2025, involving the input and participation of all stakeholders, to take stock of progress on the outcomes of the World Summit and identify areas of continued focus and challenges. The Assembly recommended that the outcome of the high-level meeting form an input into the review process for the 2030 Agenda for Sustainable Development.

83. In 2016 and 2017, the Secretary-General issued reports on the progress made in the implementation of and follow-up to the outcomes of the World Summit on the Information Society at the regional and international levels (see A/71/67-E/2016/51 and Corr.1 and A/72/64-E/2017/12).[7]

[5] For more information, see www.wipo.int/ardi.

[6] For more information, see www.wipo.int/aspi.

[7] See A/71/67-E/2016/51, footnote 1, and A/72/64-E/2017/12, footnote 1 for the lists of entities that contributed to the reports.

B. Promoting dialogue and building consensus on furthering the implementation of the World Summit outcomes

84. At its nineteenth and twentieth sessions, the Commission discussed developments and trends related to the World Summit. During those sessions, the Commission welcomed the remarkable evolution and diffusion of ICT but expressed concerns that there remained significant digital divides, such as between and within countries and between women and men, which needed to be addressed. In that context, the Commission underscored the need to urgently address the growing digital divides in the availability, affordability and use of broadband and the quality of access thereto. It also emphasized the importance of promoting an inclusive information society, taking into account the considerations of developing countries, gender and culture, as well as youth and other underrepresented groups.

C. Working Group on Enhanced Cooperation

85. In the outcome document of the high-level meeting on the overall review of the implementation of the outcomes of the World Summit, the General Assembly requested the Chair of the Commission, through the Economic and Social Council, to establish a working group to develop recommendations on how to further implement enhanced cooperation as envisioned in the Tunis Agenda for the Information Society, with the full involvement of all relevant stakeholders. The Working Group on Enhanced Cooperation will submit a report to the Commission at its twenty-first session, in 2018. The Working Group has met three times since its establishment, between September 2016 and May 2017. The fourth meeting of the Working Group will take place in September 2017 in Geneva.[6]

V. Strengthening the science-policy interface and enhancing global support mechanisms for science, technology and innovation

A. Strengthening the United Nations science-policy interface

86. The Scientific Advisory Board of the Secretary-General produced a report entitled "The future of scientific advice to the United Nations, a summary report", in September 2016. The report calls for a greater place for science in international decision-making and calls on all countries, including the poorest, to invest at least 1 per cent of their gross domestic product (GDP) on research and urge the most advanced countries to spend at least 3 per cent of GDP on research and development. In the report, the Board argues that such efforts must also focus on reinforcing science education, notably in developing countries, and on improving access for girls to science courses.

87. In paragraph 83 of the 2030 Agenda for Sustainable Development, Member States agreed that "the high-level political forum will also be informed by the *Global Sustainable Development Report*, which shall strengthen the science-policy interface and could provide a strong evidence-based instrument to support policymakers in promoting poverty eradication and sustainable development". The 2016 *Global Sustainable Development Report* builds upon the 2014 and 2015 reports. The report was an assessment of assessments, documenting and describing

[6] For more information on the Working Group, see http://unctad.org/en/Pages/CSTD/WGEC-2016-to-2018.aspx.

the landscape of information on specific issues or nexuses of issues. Its theme was "Ensuring that no one is left behind".

88. In July 2016, Member States agreed on the future scope, frequency and methodology for the *Global Sustainable Development Report* (see E/HLS/2016/1, annex). A comprehensive, in-depth report will be produced every four years to inform the high-level political forum convened under the auspices of the General Assembly. The next report will be published in 2019. Member States requested the creation of an independent group of scientists to draft the report, supported by a task team comprised of relevant United Nations system entities.

B. Technology Facilitation Mechanism

89. The Technology Facilitation Mechanism, established as part of the Addis Ababa Action Agenda and reaffirmed by the 2030 Agenda for Sustainable Development, is composed of: a United Nations inter-agency task team on science, technology and innovation for the Sustainable Development Goals, including the 10-member group of representatives from civil society, the private sector and the scientific community; a collaborative multi-stakeholder forum on science, technology and innovation for the Sustainable Development Goals; and an online platform.

90. The first multi-stakeholder forum was held on 6 and 7 June 2016 at United Nations Headquarters and addressed the topic "Realizing the potential of science, technology and innovation for all to achieve the Sustainable Development Goals". The second forum was held on 15 and 16 May 2017 at United Nations Headquarters. In addition to cross-cutting themes, the 2017 forum dedicated sessions to Goals 1, 2, 3, 5, 9 and 14, so as to promote coherence with the high-level political forum. The online platform will serve as a gateway for information on existing initiatives, mechanisms and programmes on science, technology and innovation, within and beyond the United Nations.

91. The first meeting of the 10-member group to support the Mechanism was convened on 3 and 4 March 2016 at United Nations Headquarters, to discuss the preparation for the 2016 forum and the online platform. The group held an expert group meeting on 25 and 26 January 2017, in Paris to prepare for the 2017 forum and discuss possible next steps and inputs for development of the online platform.

C. Global mechanisms for supporting science, technology and innovation

92. In the Programme of Action for the Least Developed Countries for the Decade 2011-2020 (Istanbul Programme of Action), adopted in 2011, Member States called for the establishment of a Technology Bank to help improve the least developed countries' scientific research and innovation base, promote networking among researchers and research institutions, and help the least developed countries access and utilize critical technologies.

93. Since 2011, the initiative has been supported by the Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States and reaffirmed as a priority in the Addis Ababa Action Agenda, as well as in Goal 17 of the 2030 Agenda.

94. The Technology Bank for the Least Developed Countries was established by the General Assembly, in its resolution 71/251 of 23 December 2016. The Technology Bank is expected to begin operations in 2017, with its headquarters in

Turkey. The Technology Bank will be financed by voluntary contributions from Member States and other stakeholders, including foundations and the private sector. The Technology Bank reports annually to the Assembly and is guided by a Governing Council of 13 independent experts, appointed by the Secretary-General for a period of three years.

VI. Conclusion

95. With the diverse, multidimensional, ambitious and cross-cutting nature of the Sustainable Development Goals, the 2030 Agenda for Sustainable Development requires a paradigm shift that incorporates the effective, widespread and inclusive application of science, technology and innovation.

96. The convergence of a number of new and emerging technologies provides a wide range of scientific and technical tools to address various dimensions of sustainable development, including food security and sustainable urbanization, in line with national contexts, goals and values. Such scientific and technical applications can benefit from new innovation models that promote inclusion and sustainability, technology assessment and foresight, a gender lens in developing and implementing policy on science, technology and innovation, regional and international cooperation, and financing for innovation.

97. Moreover, innovation strategies to support sustainable development require national capacities to integrate policies on science, technology and innovation into national development plans, statistics and indicators to measure innovation activities and the knowledge economy, capacities in information and communications technology to support inclusive sustainable development applications, and capabilities to harness intellectual property for the diffusion and adaptation of technologies. Furthermore, multilateral cooperation can promote a people-centred, development-oriented information society, strengthen the science-policy interface for sustainable development and support efforts for technology facilitation and capability-building, especially in developing countries and the least developed countries.